CLAIMS

What is claimed is:

l	1. A low phase-noise oscillator comprising:
2	a frequency generator to generate a reference signal at an oscillation
3	frequency responsive to a control signal;
4	a delay element comprising a high-temperature superconductor to time-
5	delay the reference signal and provide a low phase-noise time-delayed reference
6	signal; and
7	a phase detector to generate the control signal from a phase difference
8	between the low phase-noise time-delayed reference signal and a phase-shifted
9	reference signal.
1	2. The oscillator of claim 1 wherein the high-temperature superconductor
2	is disposed on a semiconductor substrate to provide the low phase-noise time-
3	delayed reference signal when cooled to within a cryogenic-temperature range.
1	3. The oscillator of claim 2 wherein the delay element comprises a
2	coplanar waveguide comprising the high-temperature superconductor, the
3	coplanar waveguide to operate as a delay line to provide the low phase-noise time-
4	delayed reference signal when cooled to within the cryogenic temperature range.
1	4. The oscillator of claim 3 wherein the coplanar waveguide is arranged on
2	the semiconductor substrate in a substantially random pattern.
1	5. The oscillator of claim 1 further comprising a cooling element to reduce
2	the temperature of the delay element.
1	6. The oscillator of claim 5 wherein the cooling element reduces the
2	temperature of the delay element to within a cryogenic temperature range.

1	7. The oscillator of claim 2 wherein the high-temperature superconductor
2	comprises Yttrium-Barium-Copper Oxide, and wherein the substrate comprises
3	either Lanthanum-Aluminum Oxide or Magnesium Oxide.
1	8. The oscillator of claim 7 wherein the delay element time-delays the
2	reference signal and provides the low phase-noise time-delayed reference signal
3	when cooled to a cryogenic temperature ranging between 30 and 120 degrees
4	Kelvin.
1	9. The oscillator of claim 1 wherein the frequency generator is a voltage
2	controlled oscillator (VCO), and the control signal is a control voltage generated
3	by the phase detector.
1	10. The oscillator of claim 9 wherein the frequency generator is surface
2	acoustic wave (SAW) VCO.
1	11. The resillation of alains 10 footbase consolidates with the 11.0 of all 1
1	11. The oscillator of claim 10 further comprising a phase shifter to phase
2	shift the reference signal to generate the phase-shifted reference signal,
3	wherein the phase shifter is a variable phase shifter to generate the phase-
4 ~	shifted reference signal having approximately ninety-degree phase difference from
5	the time-delayed reference signal.
1	12. The oscillator of claim 11 further comprising:
2	a signal splitter to split the reference signal from the frequency generator
3	and provide the reference signal to both the phase shifter and delay element; and
4	a low-pass filter to filter the control signal and provide a filtered control
5	signal to the frequency generator.
1	13. The oscillator of claim 12 wherein:
2	the delay element comprises a coplanar waveguide comprising the high-
3	temperature superconductor, the coplanar waveguide to operate as a delay line to
4	provide the low phase-noise time-delayed reference signal when cooled to a

5 cryogenic temperature;

6	the coplanar waveguide has a length between 100 and 1000 meters to
7	provide the time delay ranging from between five and fifteen microseconds;
8	the substrate has a diameter of between approximately 5 and 13
9	centimeters and the coplanar waveguide is arranged on the substrate in a
10	substantially random pattern;
11	the high-temperature superconductor comprises Yttrium-Barium-Copper
12	Oxide to be cooled to approximately 77 degrees Kelvin, and the substrate
13	comprises either Lanthanum-Aluminum Oxide or Magnesium Oxide; and
14	the oscillation frequency comprises a frequency between approximately
15	500 Mega-Hertz and six Giga-Hertz.
1	14. A receiver comprising:
2	a radio-frequency section to down-convert received RF signals using a low
3	phase-noise reference signal; and
4	an oscillator to generate the low phase-noise reference signal at an
5	oscillation frequency, the oscillator comprising a frequency generator to generate
6	the reference signal responsive to a control signal, a delay element comprising a
7	high-temperature superconductor to time-delay the reference signal and provide a
8	low phase-noise time-delayed reference signal when cooled to a cryogenic
9	temperature, and a phase detector to generate the control signal from a phase
10	difference between the time-delayed reference signal and a phase-shifted reference
l 1	signal.
1	15. The receiver of claim 14 wherein the low phase-noise reference signal
2	exhibits deviations of less than approximately 125 dBc/Hz at 10 KHz for a Ka-
3	band oscillation frequency, and less than approximately 135 dBc/Hz at 10 KHz for
4	an X-band oscillation frequency.
-	
1	16. The receiver of claim 15 wherein the delay element comprises a

2

3

4

coplanar waveguide to operate as a delay line to provide the low phase-noise time

delayed reference signal when cooled to within a cryogenic temperature range.

coplanar waveguide comprising the high-temperature superconductor, the

1	17. The receiver of claim 16 wherein the coplanar waveguide is arranged
2	on a semiconductor substrate in a substantially random pattern to provide a time-
3	delay of between 5 and 15 microseconds.
1	18. The receiver of claim 17 further comprising a cooling element to
2	reduce the temperature of the delay element to within the cryogenic temperature
3	range.
1	19. The receiver of claim 18 wherein the receiver is part of a radar system
2	to detect low-Doppler radar signals.
1	20. A method of generating a low phase-noise reference signal comprising
2	generating a reference signal at an oscillation frequency in response to a
3	control signal;
4	time delaying the reference signal with a delay element comprising a high
5	temperature superconductor cooled to within a cryogenic temperature range to
6	generate a low phase-noise time-delayed reference signal; and
7	generating the control signal from a phase difference between the time-
8	delayed reference signal and a phase-shifted reference signal.
1	21. The method of claim 20 wherein time delaying comprises time
2	delaying the reference signal through a coplanar waveguide comprising the high-
3	temperature superconductor, the coplanar waveguide operating as a delay line to
4	provide the low phase-noise time-delayed reference signal when cooled to within
5	the cryogenic temperature range.
1	22. The method of claim 21 further comprising cryogenically cooling the
2	delay element to generate the low phase-noise time-delayed reference signal.
1	23. The method of claim 21 further comprising:
2	phase shifting the reference signal to generate the phase-shifted reference
3	signal to have approximately ninety-degree phase difference from the low phase-
_	signal to have approximately inner, aegice phase difference from the low phase-

noise time-delayed reference signal;

- 5 low-pass filtering the control signal; and
- 6 controlling a frequency generator with the filtered control signal to
- 7 generate the reference signal.